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ABSTRACT

Illinois State University operates a self-paced, competency-based teacher education program known as the Professional Sequence. It is based on the General Model of Instruction used at other universities and is organized around a series of self-instructional packages. Student progress is charted by a set of computer programs called the Surveillance System which provides daily and weekly feedback. These programs also report grades and registration information and provide data to assist faculty in evaluating and modifying the instructional packages. Students are also able to use the Pyramid System to work with audio tapes and tape-slide sequences; the system tracks program utilization and its 12k Nova control unit can process computer-assisted instructional programs. The self-pacing of programs by 2000 students is made possible by extensive use of computers. To the extent that allowing students to set their learning rates and select from a number of instructional modes humanizes education, computers enable the Professional Sequence to make learning more efficient and humane. (Author)

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COMPUTERS HELP 2000 STUDENTS SELF-PACE THEIR LEARNING

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INTRODUCTION

The Department of Education at Illinois State University currently has in operation a self-paced, competency-based, teacher-preparation program known as the Professional Sequence. One of the unique aspects of this program is that each of the approximately 2000 students enrolled is free to determine not only the rate at which he progresses, but in many instances, the instructional mode by which he learns. The one factor that makes the program both viable and flexible enough to meet the individual needs of so many students is the extensive utilization of computer technology.

PROGRAM RATIONALE

The decision to replace the existing required professional education courses (Secondary School Reading, Educational Psychology (which has since been removed from the program), American Public Education, and Secondary Education), was made because both students and faculty were growing increasingly unhappy with the rigid structure of the courses and their general ineffectiveness.

It was decided to build a new program which would: (1) enable each student to learn at his own rate; (2) assure that each student would, in fact, demonstrate each required competence; (3) provide each student with accurate and continuous feedback concerning his learning progress; (4) eliminate the problem of duplication or omission of important content; (5) provide evaluations that were both meaningful and unbiased; and (6) provide for more one-to-one interaction between faculty and students.

PROGRAM ORGANIZATION

After much research it was decided to model the new program after programs currently in use at a number of other schools including Weber State University and Brigham Young University. In addition it was decided to base the program largely on the General Model of Instruction (State Objectives, Pre-assess, Instruct, Evaluate), and to utilize self-instructional packages. Self-instructional packages were selected as the primary instructional vehicle because they seemed to provide the greatest potential for both self-pacing and self-determination of learning style.

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The Professional Sequence Guide

Each of the self-instructional packages used in the Sequence was constructed by either a faculty member or a student at I.S.U., and all of the packages have been compiled into a loose-leaf booklet known as the Professional Sequence Guide. This booklet, which is sold at the cost of its printing, is the only book a student has to buy even though he may eventually earn up to eight semester hours of credit in the Sequence.

When a student looks at a typical package in this year's Guide he first finds a section label "Proficiency Test." Here he is told whether there is a proficiency test for that package and if so, how to arrange to take it.

The second section the student comes to is labeled "Precise Instructional Objectives." Here the student is told exactly what he must do to demonstrate the competencies involved. Collectively these objectives reflect those competencies deemed most important for teachers by both faculty and students at I.S.U., and practicing teachers and administrators who were polled for their opinions. Many of the objectives were adapted from competencies sought in the courses replaced by the Sequence.

The third section is labeled "Questions To Be Answered", and consists of a series of questions formulated to focus students' attention on critical aspects of the content.

Sections four and five of each package are labeled "Learning Activities-Required", and "Learning Activities-Optional." The required learning activities include those experiences the author(s) of the package feel will best prepare the student to demonstrate the objective(s) of the package. These experiences range from reading material included in self-contained packages, to reading material on reserve in the university library (and usually in dormitory libraries also), viewing tape-slide sequences and video tapes, and engaging in simulated teaching sessions. The optional activities usually include alternate instructional modes and/or sources of additional information in case the student wishes to pursue the topic further.

The final section is labeled "Evaluation", and here the student receives exact instructions telling him where and how to demonstrate the competencies involved.

Next year the package format will be slightly changed. Each package will begin with a short "Rationale" designed to help stimulate interest in the package by briefly explaining how the competencies involved relate to the teaching-learning process. In addition, the "Questions To Be Answered" section of many packages will be replaced with a "Pre-assessment" section. This will help the packages more closely fit the GMI by enabling students to determine whether they already possess the information and/or skills needed to achieve the objective(s) of the package.

Calculating Grades

A system was devised to equate work done in the Sequence, a criterion graded program, with the work done in the rest of the university, which was

mostly normatively graded and based on semester hours. After determining that students at I.S.U. were expected to spend an average of forty clock hours in class attendance, study, etc., for each semester hour they earned the faculty decided that students should be expected to spend about the same amount of time working in the Sequence for each semester hour of credit. On that basis, "merits" were assigned to each package. Since each merit represents about one clock hour of work students can tell by looking at the merit weight of each package about how long it will take them to complete it.

In order to earn one semester hour of credit a student must earn forty merits. In order to earn the possible maximum of eight semester hours the student would have to earn at least 320 merits.

In addition to accumulating merits, each student must complete certain packages before he can student teach and certain packages before he completes the program. About seventy percent of the 320 merits are in required packages while the remaining thirty percent are in optional packages included to enable students to select that information and those skills they feel will be most helpful to them.

COMPUTER APPLICATIONS

The fact that the Professional Sequence enables about 2000 students to work at their own rates, receive accurate and continuous feedback concerning their learning progress, receive printouts of their cumulative records updated each week, and receive instruction via a random-access information retrieval system, is due to the extensive utilization of computers. There are two main computer applications in the Professional Sequence.

The Surveillance System

The Surveillance System is a collective name given to a number of separate computer programs. When a student first registers for the Sequence he supplies to the Registration Office certain data including his name, social security number, academic major, the number of semester hours for which he is registering, and the time block for which he is registering. One of the programs in the Surveillance System takes this data from the computer tape used by the Registration Office and uses it to create a master file for each student. Once a master file is created for him in the Surveillance System, the student is ready to begin work.

As the student moves through various packages in the Professional Sequence he is required to demonstrate various competencies. Depending upon the package, a competency may be demonstrated by passing an objective test (most have an eighty percent criterion level) or a written test, writing a paper, teaching a simulated lesson, or some specially arranged demonstration.

All tests are taken in a testing center to which students can go at their own convenience. Answers to objective tests are recorded on mark-sensing forms along with the student's name, social security number, the package number, the number of clock hours the student spent preparing for the competence demonstration, and his evaluation of each of the required learning activities.

All hand-scored papers including written tests, papers, teaching evaluation forms, lesson plans, etc., are accompanied by a mark-sensing form coded with the student's name, social security number, the package number, the clock hours spent in preparation, and learning activity evaluations. The paper, test, etc., along with the mark-sensing form, is routed to a faculty member for grading and the mark-sensing form is returned coded either pass or fail.

Each day all available mark-sensing forms are brought to the computer center for processing. First all objective tests are graded. Secondly, all data is punched on cards for further processing by the IBM 360/50 main computer. Lastly, a printout is generated showing the social security numbers of all students whose forms were processed, the number of the package(s) they attempted, a grade of pass or "recycle" for each package, and in the case of objective tests, both the stated criterion level (in terms of the required number of correct responses) and the student's actual score (in terms of the number of correct responses). This printout is posted on a bulletin board each morning so that with the exception of hand-scored work, which takes about forty-eight hours to process, students rarely have to wait more than twenty-four hours to receive accurate reports of their learning progress.

All of the cards generated during the week are saved, and together with some individually punched cards, are used to update the cumulative records. At the beginning of each week an individual printout is made available to each student who is currently registered or working in the Professional Sequence. This printout is the student's official cumulative record of work done in the program (as of the previous Friday) and it shows all of the registration data (name, soc. sec. no., etc.); the number of merits for which the student enrolled (semester hours multiplied by forty); the number of merits completed during previous semesters; the number of semester hours officially credited; the number of excess or unregistered merits earned, the number of merits earned by completing packages during the current semester; the number of extra merits earned by completing special projects during the semester; and the total number of merits earned to date during the current semester. The printout also shows which packages were completed during previous semesters in the Sequence (designated by asterisks), which were credited as work transferred in from other schools (designated by "C"s), which packages were attempted during the current semester, and on which of four possible attempts each was passed. Without this particular printout record-keeping in the Sequence would be virtually impossible.

In addition to serving as a record-keeping device, the weekly printout is also useful in other ways. Students, for example, derive great satisfaction from seeing concrete evidence of their learning progress and many are motivated by seeing the number of merits they have completed continually increase. Another motivating factor is that a message is printed at the top of a student's printout when he has completed certain required packages, informing him that he has completed all Sequence requirements for student teaching. (The names of all such students are also compiled in a separate listing which is automatically updated each week.)

Faculty members have made a number of uses of the printouts. Many have found, for example, that the printout provides an objective basis for discussing a student's progress or lack of progress. By analyzing which packages the student has passed, failed, or avoided, faculty members are often able to detect, and offer help with, particular learning problems. Typical problems which have been discovered include: (1) that the student is hesitant about getting up to teach a lesson and is therefore avoiding the simulated teaching packages (special help in planning a lesson is then provided); (2) that the student continually fails to demonstrate competencies the first time but succeeds on the second attempt (he is advised not to skip any of the required learning activities and reminded that written permission is required before any competence can be attempted more than twice); and (3) that the student has simply stopped working (in many cases students decide to drop out of teacher education. In such cases they are called in for a short meeting and if they have, in fact, decided to go into some other field, they are removed from the Surveillance System master file). By having access to such detailed information about a student, faculty members "get to know" students on a much more personal level than was previously possible and are much more able to provide the particular kinds of help needed by each student.

A number of programs in the Surveillance System have greatly facilitated the reporting of grades and the analysis of the Sequence. To begin with, grade cards have been eliminated. At the end of each marking period the number of semester hours earned by each student is automatically transferred from the Surveillance System tape to the Record Office's tape. Semester hours are credited on the basis of blocks of forty merits completed. If, for example, a student registered for three semester hours (120 merits) but he completed only 115 merits, he would be given two hours credit (80 merits) and the remaining 35 merits would be credited to his Sequence "account" and added in the next time the student began work in the program. If students earn more semester hours than they originally registered for the excess merits are likewise credited to their "account."

Among the analysis programs is one that prints error messages if students mis-code a social security number or package number (thus helping to reconcile errors on weekly printouts), one that reports how many times each of the packages in the Sequence was passed and failed (thus making it possible to detect weak packages), one that reports the average number of hours students spent on each package and their evaluation of each of the learning activities (this data is used as a basis upon which to revise packages), and one that reports the number of students representing each academic major (thus aiding in the detection of area overloads).

Even though the Surveillance System programs are largely responsible for enabling the Professional Sequence to exist, their cost is nominal. To process an average of 3000 cards per week and generate printouts for about 2000 students the programs require only about 80K for about one hour. This represents a cost of only about one hundred dollars per week.

The Pyramid System

The second major application of computer technology in the Professional Sequence is the Pyramid System, a random-access, information-retrieval system. The hardware of the system consists of a series of audio and visual storage and playback devices (built by Ampex), and a 12K Nova mini-computer control unit (built by Data General). Altogether the Pyramid

System (Pyramid is an acronym for Program Yielding Rapid Access Major Information Devices) represents an investment of about a quarter of a million dollars on the part of the university. To help justify the expense the system will be used on a university-wide basis rather than just for the Sequence.

All of the Pyramid System software used by students in the Professional Sequence consists of either audio tapes or tape-slide sequences, and all of the programs were constructed by faculty members in the Department of Education. In many instances the programs represent alternate modes of instruction thus enabling students to either read a text or an article concerning some topic or to acquire the same information via an audio tape or a tape-slide sequence. In other instances the program is the primary instructional mode and a tape-script represents the alternate mode. It is a goal of the Sequence to offer at least one alternate mode of instruction whenever possible and to thereby give students a greater choice of how they will learn.

Students use the Pyramid System by sitting at small carrels and using a touch-tone control device to input their social security number and the code of the particular program with which they wish to work. Once this is done the system finds that particular tape, reproduces it on a student controlled playback device (in about forty-five seconds), and is ready to reproduce the same program again for another student. Since the reproduced program is directly under student control (he can stop it, start it, reverse it, and speed it up), the student can use the program until he is sure he has mastered the content it contains. The self-pacing aspect of the Pyramid System makes it highly compatible with the goal of the Professional Sequence to enable students to self-pace all of their activities in the program.

The Nova mini-computer is the heart of the Pyramid System. Its main function is to coordinate the audio parts of stored programs (which are stored on eight-track tapes) with the visual parts (which are electronically stored on rhodium disks).

The Nova also keeps track of who uses which programs and for how long, and this data is periodically printed out and used to analyze system utilization.

Lastly, the Nova is capable of processing small CAI programs. This particular application has not been heavily exploited both because the CAI programs must be short and because the university is connected, via a time-sharing system, with a much larger system at the University of Illinois. Another factor limiting the CAI application of the Nova is that CAI programs cannot be processed while the audio and visual devices of the Pyramid System are being used. With all of these limitations the Nova has been used to process at least one CAI program (dealing with the writing of precise instructional objectives) and has thus provided familiarity with CAI to at least a few students.

SUMMARY

The Professional Sequence is one of the largest, and perhaps the largest, self-paced, competency-based, teacher-preparation program in the United States. The program is based largely on the General Model of Instruction and is organized around a series of faculty and student constructed self-instructional packages.

As students move through the Professional Sequence their progress is charted by a number of computer programs collectively known as the Surveillance System. These programs provide students with daily progress reports and printouts of their cumulative records updated each week. The weekly printouts help to motivate students and enable faculty members to analyze learning patterns and thus offer more constructive advice to individual students.

The Surveillance System programs also calculate and automatically report student grades making adjustments in original registration data when necessary. In addition a variety of programs provide data which helps the faculty to assess the program's effectiveness and to make intelligent changes.

Students are able to use a random-access, information-retrieval system, known as the Pyramid System, to work with various audio tapes and tape-slide sequences at their own rates. The system keeps track of program utilization thus making it possible to revise individual programs as the need arises, and part of the system, the 12K Nova control unit, can be dedicated to processing CAI programs.

The extensive self-pacing allowed each of the 2000 students in the Professional Sequence, as well as the ability to make sense of masses of data suitable for analysis, would be extremely difficult, if not impossible, without the extensive use of computers. To the extent that enabling students to set their own learning rates and to select from among a number of instructional modes humanizes education, computers have enabled the Professional Sequence to make learning both more efficient and more humane.